REMARKS

The Office Action mailed October 19, 2005 has been reviewed and carefully considered.

Applicant gratefully acknowledges the Examiner's indication that claims 6-7 and 14-19 would be allowable if rewritten to overcome the rejection under 35 U.S.C. §112, second paragraph, and to include all of the limitations of the base claim and any intervening claims.

The Examiner's reconsideration is respectfully requested in view of the above amendments and the following remarks. Claims 1, 3-8 and 10-20 are pending in the present application. Claims 2 and 9 were cancelled without prejudice. Claims 1, 8 and 14 have been amended. No new matter has been introduced.

Applicant notes the Examiner's indication that this Office Action of October 19, 2005 is responsive to the communication filed on May 13, 2004. However, Applicant respectfully asserts that Applicant's prior substantive communication was in fact filed on October 13, 2004.

§112 REJECTIONS

Claims 1-8 and 10-20 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claim 1 has been amended to delete the term "said oscillator" in line 8 and to refer to tracking resonant frequencies of first and second electrically resonant structures and generating first and second reference signals. Thus, claim 1 now clearly identifies that the first and second resonant structures are excited with separate reference signals, each signal being of a variable frequency encompassing the possible resonant frequency of the associated resonant structure.

Claim 8 has also been amended to improve clarity, namely to refer to first and second variable frequency oscillators, as well as to first and second I-mixers and first and second filters. The phrase "thereby leaving just an amplitude modulation component of the signal" has been deleted.

While the Examiner refers to claim 10 and 14 as including the phrases "thereby leaving just an amplitude" and "so as to leave just an amplitude," Applicant respectfully asserts that these phrases actually appear in claims 8 and 14. Applicant has amended claims 8 and 14 accordingly to delete these phrases.

Claims 1 and 8 are believed to conform to current U.S. practice. Applicant notes that the amendments to claims 1 and 8 were made for clarification of the invention. The Applicant asserts that the originally filed claims are patentable over the cited art.

Claims 2-7 and 10-20 depend from and include the limitations of claims 1 and 8, respectively. Accordingly, withdrawal of the §112 rejections of claims 1-8 and 10-20 is respectfully requested.

§103 REJECTIONS

Claims 1, 3-5, 8, 10-12 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over by U.S. Patent No. 6,467,351 to Lonsdale et al. (hereinafter Lonsdale) in view of Wolff et al. (hereinafter Wolff). Applicant respectfully traverses the rejection and asserts that neither Lonsdale nor Wolff, either individually or in any combination, disclose or suggest claimed features of the present invention, as discussed further below.

By way of introduction, differences of the present invention over Lonsdale are as follows:

- The present invention can interrogate two (or more) resonators through a **single** channel (a single cable in the case of a wired sensor, a single rotary RF coupler in the case of a contactless torque sensor, or a single antenna in the case of a wireless sensor).

- The interrogation unit of the present invention does not require a directional coupler, which is a bulky and expensive component.

Fig. 1. in Lonsdale shows that the signal proportional to the reflected wave from the output of the directional coupler is processed in a "processor 5" that effectively

operates as a frequency discriminator, producing a DC signal depending on the deviation of the VFO RF carrier frequency from the resonant frequency. The structure of this 'processor 5' is disclosed in Fig. 2 and Fig. 3.

However, in Lonsdale, the RF signal from the directional coupler is applied straight away to a "detector 12" (*see e.g.,* Col. 4, lines 34-*35*) which itself works as an AM demodulator. This arrangement in Lonsdale is typical for **non-coherent** receivers. The only way in which a non-coherent receiver can receive several signals at different carrier frequencies through a single channel and separate them, is to use a bank of bandpass RF filters (or a tuneable RF filter) at its input.

However, in situations where it is required to track closely positioned frequencies of resonators with high quality factors (very high-Q resonators) this is hardly possible. For this very reason, if two resonators need to be tracked simultaneously (e.g., as in the present invention), the Lonsdales' interrogator necessarily includes **two absolutely separate** channels. FIG. 4 of Lonsdale clearly illustrates this scenario, showing two separate channels ("in-line couplers 8") that connect an interrogator and resonators 24 and 29. It is not possible for the 'processor 5' in Lonsdale to cope with a mixture of two RF signals at two different carrier frequencies that come from two resonators connected to a single in-line coupler, as achieved by the present invention. Namely, Lonsdale fails to teach or suggest at least mixing a composite response signal received from **first and second** resonant structures **with** a first reference signal, nor mixing the composite response signal of the **first and second** resonant structures **with** a second reference signal, essentially as claimed in claim 1.

In stark contrast to Lonsdale, in the present invention, the RF signal that contains

information on the resonant frequency (voltage across the resistor 4, 14 or 24, *see* FIGS. 2 or 3) is applied not to a rectifier (e.g., a non-coherent AWl demodulator as in Lonsdale) but to a mixer that mixes it with a reference RF signal (which is a copy of the signal applied to the two or more resonators). The mixer can be a simple balanced mixer 5, 15, 25 or an IQ-mixer 32, 15 or 25, 42. As a result the present invention involves a coherent receiver that has very high frequency selectivity, i.e.,it picks up RF signals having a frequency very close to the RF reference carrier frequency. For this reason a system and method according to the present invention may advantageously utilize a **single** in-line coupler (e.g., coupler 2, *see* Figs. 2 and 3) to connect two resonators to the interrogator.

It is important not to confuse the role that mixer 32 plays in the Lonsdales' patent (it compares two frequencies generated by two VFOs) with the role that mixers 15,32,25,42 play in the present invention (they are parts of coherent receivers).

Thus, Lonsdale fails to teach or suggest at least a first I-mixer mixing the excitation signal from a first oscillator with a composite response signal received from first and second resonant structures and a second I-mixer mixing a second excitation signal from a second oscillator with the composite response signal received from the first and second resonant structures, essentially as claimed in claim 8.

Wolff was cited (FIG. 2a) as showing a low pass filter connected to an output of a mixer. However, it is asserted that Wolff fails to cure the deficiencies of Lonsdale. A careful review of Wolff reveals that the role that the mixer and low pass filter (LPF) play in Wolff's system is different from the present invention. Namely, as described in the second paragraph of Section III of Wolff, the mixer and the LPF form a phase detector producing a DC voltage depending on the phase difference between the RF signal passing

through a SAW sensor and the RF signal passing through a reference channel. The aim in Wolff is clearly to measure the phase difference, because it contains information about a measurand. Using the mixer and the LPF to build the phase detector, as done in Wolff, is a well-known classical approach.

However, this approach does not have any connection with the coherent receiver employed in the present invention, which selects one particular carrier frequency associated with a particular sensor and performs down-conversion of the modulated RF signal to the baseband frequencies for further processing. Neither FIG. 2a of Wolff nor the text of the paper suggests a mixer and/or a LPF used for the same purpose. Indeed, in Wolff, multiple sensor measurements are not considered at all. Thus, Wolff fails to disclose or suggest at least mixing a composite response signal received from **first** and **second** resonant structures **with** a first reference signal, nor mixing the composite response signal of the **first and second** resonant structures **with** a second reference signal, essentially as claimed in claim 1. Moreover, Wolff fails to disclose or suggest at least a first I-mixer mixing the excitation signal from a first oscillator with a composite response signal received from first and second resonant structures and a second I-mixer mixing a second excitation signal from a second oscillator with the composite response signal received from the first and second resonant structures, essentially as claimed in claim 8.

Accordingly, claims 1 and 8 are asserted to be patentable and nonobvious over Lonsdale in view of Wolff for at least the reasons stated above. Amendments to claims 1 and 8 are for clarification of the invention. The Applicant asserts that the originally filed claims are patentable over the cited art.

Claims 3-5 and 10-12, 20 depend from and include all the limitations of claims 1 and 8, respectively. As such, the dependent claims are believed to be allowable for at least the reasons given above for claims 1 and 12.

Claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Lonsdale in view of Wolff and further in view of U.S. Patent No. 6,433,541 to Lehman et al. (hereinafter Lehman). The rejection of claim 13 is based, in part, on the Examiner's contention that Lonsdale and/or Wolff discloses or suggests the features of claim 8, from which claim 13 depends. However, it is clear that the combination of Lonsdale, Wolff and/or Lehman is legally deficient since, at the very least as explained above, neither Lonsdale or Wolff disclose or suggest the features of claim 8, from which claim 13 depends.

Accordingly, withdrawal of all the rejections under 35 U.S.C. §103(a) is respectfully requested.

CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that claims 1, 3-8 and 10-20 are patentable and nonobvious over the cited references. Consequently, the Applicant respectfully requests reconsideration and withdrawal of the rejections and allowance of the application. Such early and favorable consideration by the Examiner is respectfully urged. Should the Examiner believe that a telephone interview may facilitate resolution of any remaining matters, it is requested that the Examiner contact Applicant's undersigned attorney.

It is believed that no additional fees or charges are currently due. However, in the event that any additional fees or charges are required at this time in connection with the application, they may be charged to Applicant's representative's Deposit Account No. 50-1433.

Respectfully submitted,
KEUSEY, TUTUNJIAN & BITETTO, P.C.

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By: _____
Susan Paik
(Reg. No. 46,347)

Mailing Address:
KEUSEY, TUTUNJIAN & BITETTO, P.C.
20 Crossways Park North, Suite 210
Woodbury, NY 11797
Tel: (516) 496-3868
Fax: (516) 496-3869